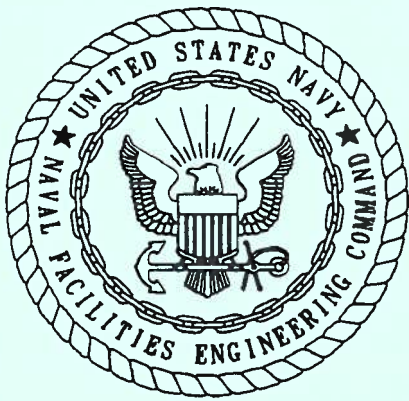


N60201.AR.002182  
NS MAYPORT  
5090.3a

TECHNOLOGY EVALUATION REPORT FOR DEMONSTRATION OF THERMAL  
DESORPTION OF PETROLEUM-IMPACTED SOIL AT SOLID WASTE MANAGEMENT UNITS  
6 AND 7 (SWMU6) (SWMU7) NS MAYPORT FL  
1/1/1998  
ABB



**TECHNOLOGY EVALUATION REPORT  
NAVY ENVIRONMENTAL LEADERSHIP PROGRAM  
TECHNOLOGY DEMONSTRATION FOR THERMAL  
DESORPTION OF PETROLEUM-IMPACTED SOIL AT  
SOLID WASTE MANAGEMENT UNITS 6 AND 7**

**U.S. NAVAL STATION  
MAYPORT, FLORIDA**

**UNIT IDENTIFICATION CODE: N60201  
CONTRACT NO.: N62467-89-D-0317/028**

**JANUARY 1998**



**SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
NORTH CHARLESTON, SOUTH CAROLINA  
29419-9010**

**TECHNOLOGY EVALUATION REPORT  
NAVY ENVIRONMENTAL LEADERSHIP PROGRAM  
TECHNOLOGY DEMONSTRATION FOR THERMAL DESORPTION OF  
PETROLEUM-IMPACTED SOIL AT  
SOLID WASTE MANAGEMENT UNITS 6 AND 7**

**U.S. NAVAL STATION  
MAYPORT, FLORIDA**

**Unit Identification Code: N60201**

**Contract No.: N62467-89-D-0317/028**

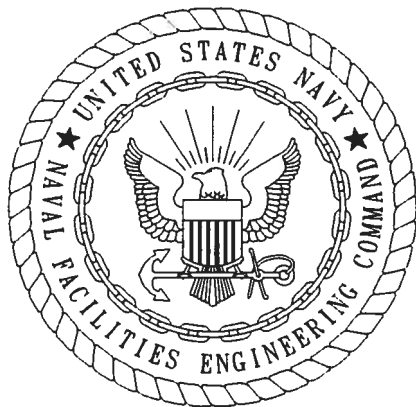
**Prepared by:**

**ABB Environmental Services, Inc.  
2590 Executive Center Circle, East  
Tallahassee, Florida 32301**

**Prepared for:**

**Department of the Navy, Southern Division  
Naval Facilities Engineering Command  
2155 Eagle Drive  
North Charleston, South Carolina 29419-9010  
David Driggers, Code 1852, Engineer-in-Charge**

**January 1997**



CERTIFICATION OF TECHNICAL  
DATA CONFORMITY (MAY 1987)

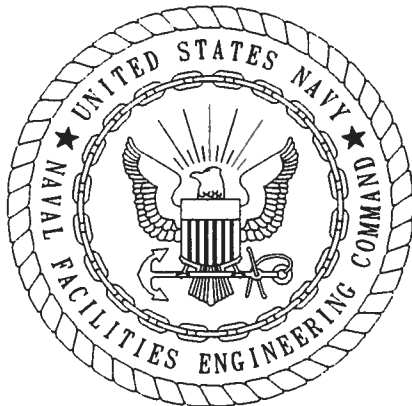
The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/028 are complete and accurate and comply with all requirements of this contract.

DATE: January 15, 1998

NAME AND TITLE OF CERTIFYING OFFICIAL: Terry Hansen, P.G.  
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Frank K. Lesesne, P.G.  
Project Technical Lead

(DFAR 252.227-7036)



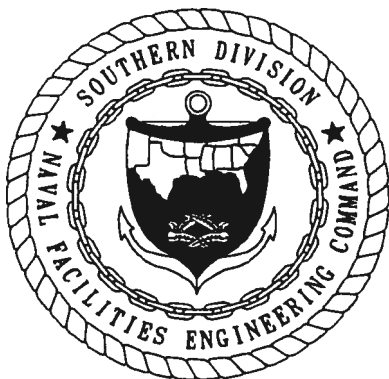
This document, *Implementation Plan Navy Environmental Leadership Program Technology Demonstration for Thermal Desorption of Petroleum-Impacted Soil at Solid Waste Management Units (SWMUs) 6 and 7*, U.S. Naval Station, Mayport, Florida, has been prepared under the direction of a Florida Registered Professional Geologist. The implementation plan rendered in this document was developed in accordance with commonly accepted procedures consistent with applicable standards of practice. The implementation plan is a guide for ABB Environmental Services, Inc., personnel to collect samples and evaluate the demonstration of thermal desorption of petroleum-impacted soil at SWMUs 6 and 7 by Southwest Soil Remediation, Inc.

If site conditions are determined to exist that differ from those described, or the technology demonstration is modified from what is described in the implementation plan, the undersigned geologist should be notified to evaluate the effects of any additional information on the proposed sampling plan presented in this document. This document was prepared for U.S. Naval Station, Mayport, Florida, and should not be construed to apply to any other site.

---

Frank K. Lesesne  
Professional Geologist  
State of Florida License No. 1020

Date: \_\_\_\_\_



## FOREWORD

In order to meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act. The acts, passed by Congress in 1980 and 1986, respectively, established the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. These acts are the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Navy Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adapted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages.

- The preliminary assessment (PA) identifies potential sites through record searches and interviews.
- A site inspection (SI) then confirms which areas contain contamination, constituting actual "sites." (Together, the PA and SI steps were called the initial assessment study under the Navy's old NACIP program.)
- Next, the remedial investigation and the feasibility study (RI/FS) together determine the type and extent of contamination, establish criteria for cleanup, and identify and evaluate any necessary

remedial action alternatives and their costs. As part of the RI/FS, a Risk Assessment identifies potential effects on human health or the environment in order to help evaluate remedial action alternatives.

- The selected alternative is planned and conducted in the remedial design and remedial action stages. Monitoring then ensures the effectiveness of the effort.

A second program to address present hazardous material management is the Resource Conservation and Recovery Act (RCRA) Corrective Action program. This program is designed to identify and clean up releases of hazardous substances at RCRA-permitted facilities. RCRA is the law that ensures that solid and hazardous wastes are managed in an environmentally sound manner. The law applies primarily to facilities that generate or handle hazardous waste.

This program is conducted in three stages.

- The RCRA facility assessment identifies solid waste management units, evaluates the potential for releases of contaminants, and determines the need for future investigations.
- The RCRA facility investigation then determines the nature, extent, and fate of contaminant releases.
- The corrective measures study identifies and recommends measures to correct the release.

The hazardous waste investigations at Naval Station Mayport are presently being conducted under the RCRA Corrective Action program. Earlier preliminary investigations had been conducted at Naval Station Mayport under the Navy's old NACIP program and IR program following Superfund guidelines. In 1988, in coordination with the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (FDEP), the hazardous waste investigations were formalized under the RCRA program.

Naval Station Mayport is conducting the cleanup at their facility by working through the Southern Division, Naval Facilities Engineering Command. The USEPA and the FDEP oversee the Navy environmental program. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the RCRA program at Naval Station Mayport should be addressed to Mr. David Driggers, Code 1852, at (803) 743-0501.

## EXECUTIVE SUMMARY

As part of the Navy Environmental Leadership program, the Navy contracted Southwest Soil Remediation, Inc. (SSR), of Tucson, Arizona, to conduct a technology demonstration of low temperature thermal desorption (LTTD) of petroleum-contaminated soil at Naval Station Mayport. The demonstration was performed at Solid Waste Management Units (SWMUs) 6 and 7, the Waste Oil Pit, and Sludge Drying Beds. Target treatment levels were set according to Florida Administrative Code (FAC) 62-775, Thermal Treatment Facilities for Petroleum Contaminated Soil. ABB Environmental Services, Inc., collected baseline and performance evaluation soil samples to evaluate the effectiveness of the technology demonstration.

The LTTD technology demonstration appears to have been effective in meeting the requirements of FAC 62-775 for the petroleum-impacted soil at SWMUs 6 and 7. However, there is some uncertainty associated with the lack of documentation (SSR, 1996) concerning whether or not some of the piles were retreated and the results of the retreatment.



## TABLE OF CONTENTS

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Chapter	Title	Page No.
1.0	INTRODUCTION . . . . .	1-1
1.1	SITE DESCRIPTION AND BACKGROUND, SWMUs 6 AND 7 . . . . .	1-1
1.2	TREATMENT LEVELS FOR SOIL CONTAINING PETROLEUM-RELATED PRODUCTS AT SWMUs 6 AND 7 . . . . .	1-5
1.3	VOLUME OF SOIL CONTAINING PETROLEUM-RELATED PRODUCTS AT SWMUs 6 AND 7 . . . . .	1-5
1.4	TECHNOLOGY EVALUATION REPORT CONTENTS . . . . .	1-7
2.0	SUMMARY OF TECHNOLOGY DEMONSTRATION AT SWMUs 6 AND 7 . . . . .	2-1
2.1	SSR's TECHNOLOGY DEMONSTRATION ACTIVITIES . . . . .	2-1
2.2	TECHNOLOGY DEMONSTRATION OVERSIGHT . . . . .	2-1
	2.2.1 Baseline Soil Sampling . . . . .	2-5
	2.2.2 Performance Evaluation Sampling of Treated Soil . . . . .	2-5
	2.2.3 Sampling Procedures . . . . .	2-5
	2.2.4 Analytical Program . . . . .	2-6
3.0	RESULTS AND EVALUATION OF TECHNOLOGY DEMONSTRATION SAMPLING . . . . .	3-1
3.1	ANALYTICAL RESULTS . . . . .	3-1
4.0	EVALUATION OF TECHNOLOGY DEMONSTRATION . . . . .	4-1
5.0	CONCLUSIONS . . . . .	5-1

### REFERENCES

### APPENDICES

- Appendix A: Volume Estimates of Soil Containing Petroleum-Related Products
- Appendix B: Technology Demonstration Photographs
- Appendix C: Sampling Calculations
- Appendix D: Analytical Data
- Appendix E: Data Validation Reports
- Appendix F: Copy of ABB-ES Site Logbook
- Appendix G: Response to Regulatory Comments

## LIST OF FIGURES

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

<u>Figure</u>	<u>Title</u>	<u>Page No.</u>
1-1	Facility Location Map . . . . .	1-2
1-2	Group II Solid Waste Management Unit (SWMU) Locations . . . . .	1-3
1-3	Solid Waste Management Units (SWMUs) 6 and 7 General Site Features .	1-4
2-1	Approximate Location of Low Temperature Thermal Desorption (LTTD) Unit and Storage Cells . . . . .	2-2

## LIST OF TABLES

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

<u>Table</u>	<u>Title</u>	<u>Page No.</u>
1-1	Target Treatment Levels for Soil Based on Thermal Treatment of Petroleum-Contaminated Soil . . . . .	1-6
3-1	Summary of Analytes Detected in Pretreatment Soil Samples at SWMUs 6 and 7 . . . . .	3-2
3-2	Summary of Analytes Detected in Posttreatment Soil Samples at SWMUs 6 and 7 . . . . .	3-3
4-1	Pretreatment Analytical Results . . . . .	4-2
4-2	Treatability Test Analytical Results . . . . .	4-3
4-3	Posttreatment Analytical Results . . . . .	4-4

## GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
BTEX	benzene, toluene, ethylbenzene, xylene
CMS	corrective measures study
ESI	expanded site investigation
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
LNAPL	light nonaqueous-phase liquid
LTTD	low temperature thermal desorption
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
NAVSTA	Naval Station
NEESA	Naval Energy and Environment Support Activity
NELP	Navy Environmental Leadership program
NIRP	Navy Installation Restoration program
OWTP	oily waste treatment plant
PAH	polynuclear aromatic hydrocarbon
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SSR	Southwest Soil Remediation, Inc.
SWMU	solid waste management unit
TRPH	total recoverable petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
VOA	volatile organic aromatic
VOH	volatile organic halocarbon

## 1.0 INTRODUCTION

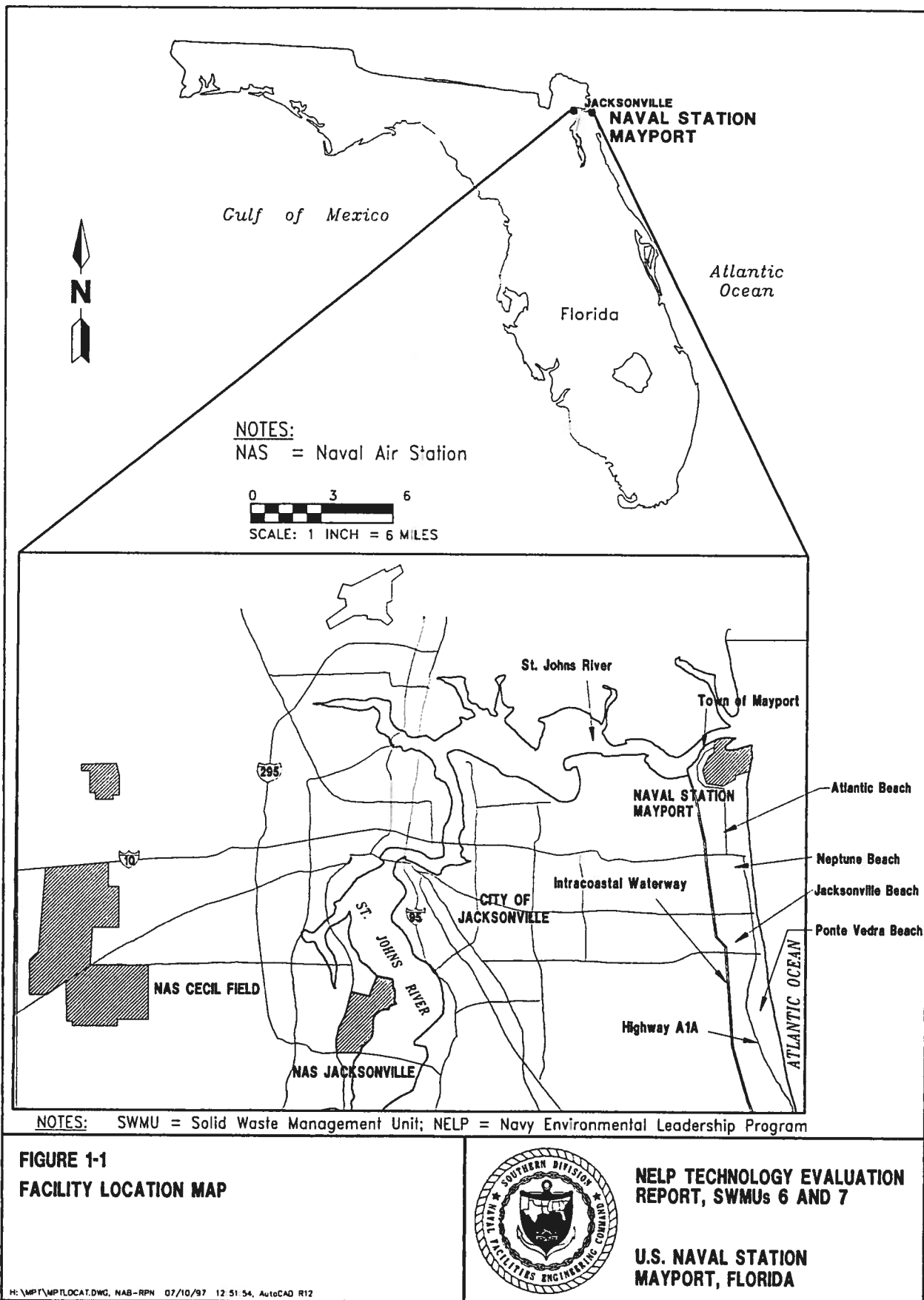
A technology demonstration was conducted under the Navy Environmental Leadership program (NELP) by Southwest Soil Remediation, Inc. (SSR), of Tucson, Arizona, to conduct thermal desorption of petroleum-impacted soil and related organic compounds at Solid Waste Management Units (SWMUs) 6 and 7 at U.S. Naval Station (NAVSTA), Mayport, Florida (Figures 1-1 and 1-2). NELP was created to promote the use of new and innovative technologies in the areas of compliance, conservation, cleanup, and pollution prevention within the Navy. NAVSTA Mayport was selected to participate in NELP because activities at this station are representative of similar activities at other naval stations.

ABB Environmental Services, Inc. (ABB-ES), was contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command to provide technical oversight for the technology demonstration at SWMUs 6 and 7.

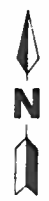
1.1 SITE DESCRIPTION AND BACKGROUND, SWMUs 6 AND 7. SWMU 6 (Waste Oil Pit) is located beneath the westernmost sludge drying bed (SWMU 7) of the oily waste treatment plant (OWTP) (Figure 1-3). Historical information concerning the operation of SWMUs 6 and 7 was obtained from the Resource Conservation and Recovery Act (RCRA) facility assessment conducted by A.T. Kearney in 1989 on behalf of the U.S. Environmental Protection Agency (USEPA). SWMU 6 was operated in the 1970s as an unlined pit for bilge water that contained oily wastes. The pit was excavated to a depth of approximately 6 feet beneath the land surface. Bilge water was pumped directly from the ships berthed at Mayport Turning Basin into the pit. Waste oil placed in SWMU 6 may have contained other substances such as solvents and transformer oils. Bilge water or oily wastes placed in SWMU 6 seeped into the underlying soils. Estimates indicate that over 250,000 gallons of bilge water and several thousand gallons of waste oil were disposed of in the pit (A.T. Kearney, 1989). In 1979, SWMU 6 was filled and covered; the westernmost sludge drying bed at SWMU 7 was constructed over the central and southern part of SWMU 6 (Figure 1-3) (A.T. Kearney, 1989).

SWMUs 6 was constructed to receive bilge water directly from ships berthed at NAVSTA Mayport. SWMU 7 was constructed to replace SWMU 6 and initially received petroleum hydrocarbons and related chemicals that settled (as sludge) to the bottom of bilge water receiving tanks (the three tanks are part of SWMU 51, Figure 1-2). Each sludge drying bed is about 150 feet in length and 50 feet wide, unlined, and enclosed by an earthen berm. When these holding tanks were at capacity, bilge water overflow was pumped directly into the sludge drying beds. Subsequently, the OWTP was constructed, and SWMU 7 received sludge at the OWTP. Anecdotal information suggests that the drying beds received approximately 3,000 gallons of sludge a week while the OWTP was in operation (A.T. Kearney, 1989). Figures 1-2 and 1-3 show the location and general features of SWMUs 6 and 7.

An initial assessment study, conducted as part of the Navy Installation Restoration program (NIRP), identified SWMU 6 as a NIRP site based on the potential for the bilge water to have been released to the environment and recommended an expanded site investigation (ESI) (Environmental Science and Engineering, Inc., 1986). SWMU 7 was not identified as a NIRP site. An ESI was conducted in 1988 for SWMU 6, which included the collection of soil and ground-



ST. JOHNS RIVER



SWMU-11

SWMU-51

SWMU-7

SWMU-6

SWMU-12

SWMU-16

SWMU-9

SWMU-10

SWMU-8

SWMU-15

MAYPORT  
TURNING  
BASIN

**LEGEND**



Approximate SWMU boundary

**NOTES:**

NELP = Navy Environmental Leadership Program

**FIGURE 1-2**

**GROUP II SOLID WASTE MANAGEMENT UNIT  
(SWMU) LOCATIONS**



**NELP TECHNOLOGY EVALUATION  
REPORT, SWMUs 6 AND 7**

**U.S. NAVAL STATION  
MAYPORT, FLORIDA**

**TOWN OF  
MAYPORT**

0 200 400  
SCALE: 1 INCH = 400 FEET





water samples. During the ESI, light nonaqueous-phase liquid (LNAPL), related to petroleum products, was found on the water table hydraulically downgradient of SWMU 6 (E.C. Jordan, 1988). Both SWMUs 6 and 7 were identified in the Hazardous and Solid Waste Amendments permit for NAVSTA Mayport as requiring an RCRA facility investigation (RFI).

An RFI was completed for SWMUs 6 and 7 in 1994 (ABB-ES, 1995a). The results of the RFI for SWMUs 6 and 7 suggest that petroleum-related products have been released at these SWMUs and are contributing to the presence of LNAPL hydraulically downgradient of the SWMUs. SWMU 6 was identified as the primary source of the LNAPL, as petroleum was often released directly to the unlined waste oil pit.

A corrective measures study (CMS) for SWMUs 6 and 7 identified a corrective action objective to eliminate petroleum-impacted soil at SWMUs 6 and 7 that contributes to the presence of LNAPL (ABB-ES, 1995b). During the selection and evaluation of corrective action alternatives for the CMS, the NELP technology demonstration was taken into consideration.

1.2 TREATMENT LEVELS FOR SOIL CONTAINING PETROLEUM-RELATED PRODUCTS AT SWMUs 6 AND 7. Because remedial activities were planned at SWMUs 6 and 7, a human health and ecological risk assessment for exposure to petroleum-impacted soil was not conducted; therefore, no remedial goal options were selected.

Target treatment levels selected in the CMS for petroleum-impacted soil at SWMUs 6 and 7 were based on the Florida Department of Environmental Protection (FDEP) regulation, *Thermal Treatment Facilities for Petroleum Contaminated Soil*, Florida Administrative Code (FAC) 62-775. This regulation provides treatment standards for soil containing petroleum-related products when thermal treatment is used (ABB-ES, 1995b). Table 1-1 shows the treatment levels that thermal treatment must achieve based on FAC 62-775.

1.3 VOLUME OF SOIL CONTAINING PETROLEUM-RELATED PRODUCTS AT SWMUs 6 AND 7. The volume of soil containing petroleum-related products was calculated as part of the CMS. Appendix A provides detailed information on these calculations. In summary, the volume of soil containing petroleum-related products at SWMUs 6 and 7 was calculated using the following assumptions:

- Soil in the vadose zone at the sludge drying beds is contaminated with petroleum hydrocarbons.
- Soil berms surrounding the sludge drying beds are not contaminated.
- SWMU 6 was backfilled with clean soil to a depth of 3 feet and, therefore, is not contaminated (except where SWMU 7 overlaps).
- Petroleum-impacted soil disposed of in the easternmost sludge drying bed was excavated and placed in the adjacent sludge drying bed during construction of the load equalization tanks in 1989. Therefore, the easternmost sludge drying bed is not contaminated.

**Table 1-1**  
**Target Treatment Levels for Soil Based on**  
**Thermal Treatment of Petroleum-Contaminated Soil**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Constituent	Target Treatment Level <sup>1</sup>
Total recoverable petroleum hydrocarbons	<sup>2</sup> 50
Volatile organic aromatics (BTEX)	<sup>3</sup> 100
Volatile organic halocarbons	<sup>3</sup> 50
Polynuclear aromatic hydrocarbons	<sup>3</sup> 1,000
Arsenic	10
Barium	4,940
Cadmium	37
Chromium	50
Lead	108
Mercury	23
Selenium	389
Silver	353

<sup>1</sup> Target treatment levels are specified in the Florida Administrative Code (FAC) 62-775. The values are in milligrams per kilogram (mg/kg) unless noted otherwise.  
<sup>2</sup> If total recoverable petroleum hydrocarbons are below 10 mg/kg, polynuclear aromatic hydrocarbons and volatile organic halocarbons do not have to meet the target treatment levels listed in this table, as per FAC 62-775.  
<sup>3</sup> Micrograms per kilogram.

Notes: SWMU = solid waste management unit.  
BTEX = benzene, toluene, ethylbenzene, and xylene.

The total volume of soil containing petroleum-related products at SWMUs 6 and 7 was estimated to be 29,800 cubic yards or approximately 35,200 tons (ABB-ES, 1995b).

1.4 TECHNOLOGY EVALUATION REPORT CONTENTS. This Technology Evaluation Report includes the following:

- a description of the technology demonstrated;
- a summary of operations and sampling performed by SSR during the demonstration;
- a description of technical oversight activities performed by ABB-ES, including photographs, observations, and analytical results;
- an evaluation of the technology demonstration by comparison of analytical results to target treatment levels;
- and finally, conclusions based on findings from the technology demonstration.

## 2.0 SUMMARY OF TECHNOLOGY DEMONSTRATION AT SWMUs 6 AND 7

Through NELP, the Navy proposed to demonstrate low temperature thermal desorption (LTTD) of soil containing petroleum-related products at SWMUs 6 and 7 (SSR, 1995). SSR was contracted by the Navy to perform this demonstration. Photographs of the technology demonstration activities are provided in Appendix B.

This chapter includes an overview of the technology demonstration and description of the sampling activities conducted by both SSR and ABB-ES during the technology demonstration.

2.1 SSR's TECHNOLOGY DEMONSTRATION ACTIVITIES. SSR excavated approximately 2,400 tons of soil containing petroleum-related products from SWMUs 6 and 7. Soil containing petroleum-related products was excavated from two areas. Approximately 1,920 tons were excavated from the SWMU 7 sludge drying bed, and approximately 480 tons were excavated north of SWMU 7 in an area that formerly was within SWMU 6 (Figure 2-1).

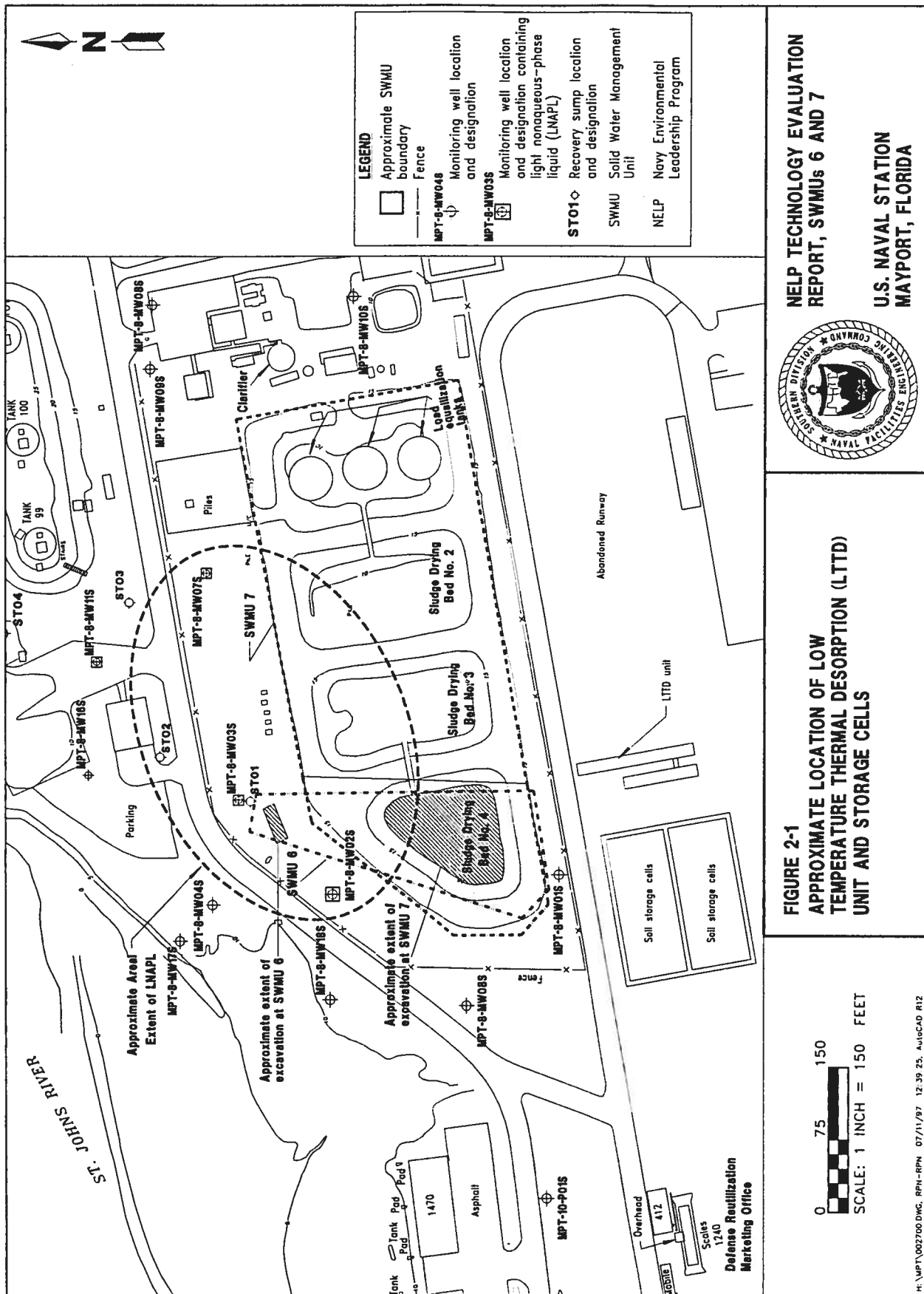
Prior to conducting full-scale operations, a small-scale treatability test of the LTTD unit was conducted on April 15 and 16, 1996. Approximately 100 tons of petroleum-impacted soil (five 20-ton stockpiles) was treated during a 12-hour period. The soil was tested in batches of 20 tons to ensure that the unit produced soil meeting the thermal desorption target treatment levels (Table 1-1).

SSR uses the operating parameters determined from the treatability test to determine the most effective settings to operate during full treatment. The LTTD unit went to full-scale (24 hours per day) operation on April 17, 1996. Treatment of the remaining 2,300 tons of petroleum-impacted soil and retreatment of the treatability tested soil occurred during full-scale operation from April 17 through May 4, 1996 (SSR, 1996).

Treated soil was placed in a storage area designed to hold 1,500 tons. The treated soil was stored in individual 100-ton stock piles until treatment was confirmed by chemical analysis. Please refer to SSR's *Summary Report, Naval Station, Mayport, Florida, Oily Waste Treatment Plant, SWMU No. 6 and 7* (1996), for details on the petroleum-impacted soil excavation and operation of the LTTD unit.

SSR collected soil samples, prior to and during the demonstration, to monitor the performance of the LTTD unit and to meet the requirements of FAC 62-775. Please refer to SSR's *Summary Report, Naval Station, Mayport, Florida, Oily Waste Treatment Plant, SWMU No. 6 and 7* (1996), for details on the soil sampling and analysis program conducted by SSR.

2.2 TECHNOLOGY DEMONSTRATION OVERSIGHT. ABB-ES provided technical oversight of the NELP technology demonstration contractor, SSR. ABB-ES was on site during the technology demonstration to observe the contractor's activities, which include the following:



- site preparation,
- construction of the LTDD,
- operation and maintenance activities, and
- soil sampling.

Site Preparation. Site preparation at SWMUs 6 and 7 commenced on April 2, 1996, and included the construction of soil storage cells, soil excavation, and soil stockpiling prior to setup of the LTDD unit. The storage cells were constructed on an asphalt parking lot located south of SWMUs 6 and 7 and less than 50 feet from the LTDD unit (Figure 2-1).

SSR personnel used a trackmounted back-hoe and front-end loader to excavate and transport soil from the SWMU 7 sludge bed to the soil storage cell. Soil from the SWMU 7 sludge bed berm, assumed to be clean, was used to construct the containment berms for the storage cells. Two separate storage cells were constructed and lined with 10-mil plastic, one for petroleum-impacted soil, and one for "clean soil" or treated soil that might require retreatment.

After completion of the soil storage cells, SSR excavated approximately 960 tons of petroleum-impacted soil from the SWMU 7 sludge bed. The excavated materials were transported and stockpiled within the designated storage cell, which was constructed to store approximately 2,000 tons of soil. The excavation depths ranged from 3 to 5 feet beneath the bottom of the sludge drying bed. The materials excavated included sand intermixed with oyster shells.

Five 20-ton stockpiles were created for a treatability test trial burn. The remainder of the excavated material was placed in an 860-ton stockpile. Please refer to SSR's *Summary Report, Naval Station, Mayport, Florida, Oily Waste Treatment Plant, SWMU No. 6 and 7* (1996), for details on the excavation of petroleum-impacted soil.

Construction of the LTDD. Construction commenced on April 4, 1996, and included the assembly of the LTDD unit. The LTDD unit consisted of two main operating units: the primary treatment unit that included the feeder bin, rotary dryer, and baghouse and the secondary treatment unit that included the thermal oxidizer and air stack assembly.

The treatment unit of the thermal desorber is a rotary dryer that is 4 feet in diameter and 20 feet long. Typically, soil is treated at 600 to 700 degrees Fahrenheit and is cooled to 300 to 450 degrees Fahrenheit upon exiting with water. The other unit treats exhaust gases that contain particulates and volatile organic compounds. Exhaust gas was treated by collecting particulate in a pulse jet baghouse, and the gas portion was treated in a thermal oxidizer. The thermal oxidizer operates at 1,300 to 2,000 degrees Fahrenheit with a residence time of one second.

The two units were mobilized separately and then assembled at the site prior to testing and operation. Please refer to SSR's *Summary Report, Naval Station, Mayport, Florida, Oily Waste Treatment Plant, SWMU No. 6 and 7* (1996), for details on the LTDD unit set up.

Operation and Maintenance Activities. Operation and Maintenance of the LTDD unit commenced on April 15, 1996, with a treatability test trial burn and continued at full-scale operation until completion of the technology demonstration on May

4, 1996. During the treatability test, the soil was treated at different feed rates and temperatures to determine the optimum feed rate and temperature for full-scale treatment. The treatability test of the five 20-ton stockpiles was conducted over a 12-hour period. The feed rates varied from approximately 6 to 10 tons per hour and achieved soil temperatures of 690 to 725 degrees Fahrenheit (SSR, 1996). Treatability test results indicated that higher temperatures would be required for full scale operation because of the higher than expected moisture content and the amount of oyster shells incorporated into the soil matrix.

Daily operation under full-scale 24-hour-a-day operations began on April 17, 1996. Full-scale operations included continued soil excavation using the excavator/front-end loader, stockpiling soil, and operation of the LTDD unit. Additionally, soil treated during the treatability testing was retreated to ensure complete treatment.

The feed rate for the full-scale operation ranged from 6 to 9 tons per hour during full-scale operation. This feed rate resulted in the creation of three 100-ton stockpiles of treated soil each day. The stockpiles were marked to track analytical results to assess whether or not the treatment criteria were met.

The temperatures achieved during full-scale operation generally ranged from 740 to 1,000 degrees Fahrenheit (SSR, 1996).

SSR also screened out material that had a size greater than a 2-inch-square mesh. The material was placed in a roll-off container that was supplied by the Navy. Approximately 1/3 of a ton of material was screened out. Disposal of this material was the responsibility of the Navy.

Site maintenance included general organization and site cleanup, which included keeping the storage cells in good condition, replacing 10-mil plastic when necessary, and keeping the work area near the LTDD feeder bin free of objects and debris that might interfere with loader operations. Maintenance of the LTDD unit included general daily maintenance and system checks to ensure the unit and other necessary equipment were in proper working order. Please refer to SSR's *Summary Report, Naval Station, Mayport, Florida, Oily Waste Treatment Plant, SWMU No. 6 and 7* (1996), for details on the operation and maintenance of the LTDD unit.

Soil Sampling. SSR collected soil samples to monitor and assess the performance of the LTDD unit. SSR collected soil samples before and during the NELP technology demonstration as required under FAC 62-775. SSR collected pretreatment soil samples to evaluate concentrations of organics, inorganics, and total recoverable petroleum hydrocarbons (TRPH) in the petroleum-impacted soil.

SSR collected one grab sample every hour and composited these grabs every 8 hours (SSR, 1996).

SSR also collected samples during the technology demonstration to evaluate the operation of the LTDD and to ensure that the treated soil met the requirements of FAC 62-775. Treated soil was stockpiled on site (approximately 70- to 80-ton stockpiles) until SSR verified through sample analysis that the treated soil met the thermal desorption target treatment levels.

The ABB-ES soil sampling and analysis program consisted of two parts: the collection of baseline (pretreatment) soil samples, and the collection of

performance evaluation (posttreatment) samples that were then compared to the treatment criteria specified under FAC 62-775.

**2.2.1 Baseline Soil Sampling.** Baseline soil samples were collected prior to SSR conducting the treatability test portion of the technology demonstration. Five composite samples were collected for the first 1,400 tons of petroleum-impacted soil to be treated, and an additional composite sample was collected for each 700 tons thereafter (SSR treated approximately 2,400 tons of soil), as required by FAC 62-775. Based on these criteria, seven composite soil samples were collected (MPT-7-SS01 through MPT-7-SS07) prior to the treatability test. The calculation for determining the number of soil samples is provided in Appendix C.

Each composite soil sample consisted of four discreet grab samples taken from locations randomly distributed throughout the five 100-ton stockpiles and the 860-ton stockpile. The grab samples were collected at a minimum depth of 6 inches below the surface of the petroleum-impacted soil stockpiles.

**2.2.2 Performance Evaluation Sampling of Treated Soil.** Performance evaluation soil samples were collected to assess whether or not thermal desorption had achieved target treatment levels specified in FAC 62-775.

ABB-ES collected soil samples from the treated soil stockpiles to assess whether or not the thermal desorption target treatment levels had been achieved. The following information and parameters were used to determine the number of samples.

- The LTTD unit, when at full scale, operated for 24 hours per day at an average throughput rate of 7 to 9 tons per hour (approximately 200 tons per day).
- Approximately 2,400 tons of soil were treated in 17 days during this demonstration.

The *Guidelines for Assessment and Remediation of Petroleum Contaminated Soil* (FDEP, 1994) stipulates that a grab sample should be collected every 50 tons of treated soil and composited every 400 tons. ABB-ES collected one composite sample for every 400 tons of treated soil designated as achieving target treatment levels by SSR. Each composite consisted of eight grab samples: one to two grab samples collected from each 56- to 72-ton stockpile. Based on the above criteria, eight performance evaluation (posttreatment) samples (MPT-7-SS8 through MPT-7-SS15) and one duplicate were collected by ABB-ES.

**2.2.3 Sampling Procedures.** The methodology for soil sample collection was consistent with standard operating procedures described in the NAVSTA Mayport RFI workplan (ABB-ES, 1991), the NAVSTA Mayport General Information Report (ABB-ES, 1995c), and USEPA Region IV standard operating procedures (USEPA, 1991).

The grab samples were collected using a decontaminated stainless-steel hand auger. Soil from the stainless-steel hand auger was transferred to a glass (Pyrex™) bowl using a stainless-steel spoon. Once all necessary grab samples had been collected for a corresponding composite sample, grab samples were homogenized and transferred to an appropriate sample container. The soil samples were placed in a cooler with ice and shipped by express-overnight delivery to a



Naval Energy and Environment Support Activity (NEESA)-approved laboratory under chain-of-custody protocol.

2.2.4 Analytical Program. The baseline samples were analyzed for volatile organic aromatics (VOAs, which include benzene, toluene, ethylbenzene, and xylenes [BTEX]), volatile organic halocarbons (VOHs), polynuclear aromatic hydrocarbons (PAHs), total organic halides, metals (total), and TRPH using appropriate test methods.

The performance evaluation soil samples were analyzed for VOAs, PAHs, total organic halides, metals (total), and TRPH as stated in FAC 62-775.

The soil samples were analyzed using SW-846 methods for organics, inorganics, and TRPH contained in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW846 (USEPA, 1986). The analytical data package produced by the laboratory was NEESA Level C.

NEESA Level C was used to provide analytical data that could be validated substituting the SW-846 method criteria for USEPA's Contract Laboratory Program method criteria using National Functional Guidelines for Organic Data Review (USEPA, 1990). The data have been validated so that appropriate decisions were made as to whether or not soil at the site should be further evaluated by the CMS under NAVSTA Mayport's RCRA Corrective Action program. Summaries of the analytical data are provided in Appendix D, and data validation reports are provided in Appendix E. A copy of the ABB-ES site logbook containing all oversight activities is provided in Appendix F.

### 3.0 RESULTS AND EVALUATION OF TECHNOLOGY DEMONSTRATION SAMPLING

This chapter presents analytical results from baseline and performance sampling events and an evaluation of the results relative to the thermal desorption target treatment goals.

3.1 ANALYTICAL RESULTS. Below is a general overview of analytical results for soil samples collected during the baseline and performance evaluation sampling events.

Baseline Composite Soil Sampling. VOHs, PAHs, and total organic halides (halogenated organic chemicals such as solvents), if present, were not detected at concentrations exceeding the detection limit. Two VOAs, ethylbenzene, and xylenes were detected in the baseline soil samples (Table 3-1). Ethylbenzene was detected at concentrations ranging from 9.3 to 100 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ), and xylenes (total) were detected at concentrations ranging from 26 to 62  $\mu\text{g}/\text{kg}$ . Seven inorganic analytes (arsenic, barium, cadmium, chromium, lead, mercury, and selenium) were detected in the baseline composite soil samples. TRPH was detected at concentrations ranging from 3,540 to 10,900 milligrams per kilogram ( $\text{mg}/\text{kg}$ ) in the baseline composite soil samples.

The analytical results for total organic halides suggest that hazardous substances that are not allowed to be treated by thermal desorption, if present, are not at concentrations that would preclude the use of thermal desorption to remediate the soil.

Prior to treatment, two of the baseline soil samples (MPT-7-SS02, and MPT-7-SS06) contained VOAs (ethylbenzene and xylenes) (Table 3-1) at concentrations that exceeded the thermal desorption treatment criteria (Table 1-1). Each of the soil samples contained TRPH at concentrations that exceeded the thermal desorption treatment criteria. The baseline analytical results were compared to the treatment levels to identify which petroleum-related constituents exceeded the treatment criteria and should also be evaluated in the performance samples.

Performance Composite Soil Sampling. VOAs (BTEX), if present, were not detected at concentrations that exceeded the detection limit. A PAH, naphthalene, was detected in a performance evaluation soil sample (MPT-7-SS10) (Table 3-2). Six inorganic analytes (arsenic, barium, chromium, lead, mercury, and silver) were detected in the performance evaluation soil samples. TRPH was detected at concentrations ranging from 16.9 to 46.1  $\text{mg}/\text{kg}$  in five of the performance evaluation soil samples.

None of the target analytes were detected at concentrations that exceeded the thermal desorption treatment criteria (Table 1-1).

**Table 3-1**  
**Summary of Analytes Detected in Pretreatment Soil Samples at SWMUs 6 and 7**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Analytical Batch Number:	MA660	MA660	MA660	MA719	MA719	MA830	MA830	MA830	MA865
Sample Location:	MPT-7-SS01	MPT-7-SS01	MPT-7-SS02	MPT-7-SS03	MPT-7-SS04	MPT-7-SS05	MPT-7-SS06	MPT-7-SS07	
Sample Number:	07S00101	07S00101D	07S00201	07S00301	07S00401	07S00501	07S00601	07S00701	
Date Sampled:	04-APR-96	04-APR-96	05-APR-96	12-APR-96	12-APR-96	17-APR-96	25-APR-96	01-MAY-96	
<b><u>Volatile Organic Compounds (µg/kg)</u></b>									
Ethylbenzene	13	12	100	9.3	--	--	78	--	
Xylenes	64	59	57	48	--	--	26	--	
VOAs	77	71	157	57.3	--	--	104	--	
<b><u>Inorganic Analytes (mg/kg)</u></b>									
Arsenic	0.33 J	--	1 J	1.2 J	2.3	0.61 J	0.45 J	--	
Barium	7.4 J	8.3 J	8.8 J	7 J	6.8 J	9.5 J	3.7 J	6.3 J	
Cadmium	--	--	--	0.44 J	--	--	--	--	
Chromium	--	4.1	4.6	4.1	3.1	4.7	--	2.9	
Lead	4.7 J	4.5 J	5.5 J	5.8 J	5.4 J	4.6 J	0.99 J	2.4 J	
Mercury	0.09 J	0.75	--	--	--	0.08 J	--	--	
Selenium	--	0.29 J	--	--	--	--	--	--	
<b><u>Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)</u></b>									
TRPH	11,500	10,300	10,200	6,410	10,300	8,020	10,200	3,540	
Notes: SWMU = solid waste management unit. D = duplicate. µg/kg = micrograms per kilogram. -- = analyte not detected VOAs = the total concentrations for benzene, toluene, ethylbenzene, and xylenes. mg/kg = milligrams per kilogram. J = estimated value.									

**Table 3-2**  
**Summary of Analytes Detected in Posttreatment Soil Samples at SWMUs 6 and 7**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Analytical Batch Number:	MA752	MA781	MA781	MA802	MA802	MA831	MA866	MA866	MA866
Sample Location:	MPT-7-SS08	MPT-7-SS09	MPT-7-SS09	MPT-7-SS10	MPT-7-SS11	MPT-7-SS12	MPT-7-SS13	MPT-7-SS14	MPT-7-SS15
Sample Number:	07S00801	07S00901	07S00901D	07S01001	07S01101	07S01201	07S01301	07S01401	07S01501
Date Sampled:	16-APR-96	19-APR-96	19-APR-96	23-APR-96	23-APR-96	26-APR-96	01-MAY-96	02-MAY-96	06-MAY-96
<b><u>Polynuclear Aromatic Hydrocarbons (µg/kg)</u></b>									
Naphthalene	--	--	--	--	54	--	--	--	--
PAHs (Total)	--	--	--	--	54	--	--	--	--
<b><u>Inorganic Analytes (mg/kg)</u></b>									
Arsenic	0.72 J	0.63 J	0.75 J	0.54 J	0.43 J	0.68 J	--	--	--
Barium	10.1 J	9.7 J	9.5 J	8.2 J	8 J	7.3 J	6.6 J	6.4 J	7.4 J
Chromium	4.1	5.1	4	3.4	3.1	3.2	2.6	--	3.1
Lead	6.7	4.6	5	2.6	4	5.7 J	2.9 J	2.7	4.1 J
Mercury	--	--	--	0.04 J	0.06 J	0.05 J	0.05 J	0.05 J	--
Silver	--	--	0.74 J	--	--	--	--	--	--
<b><u>Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)</u></b>									
TRPH	53.2	39	41.3	42.7	19.7	16.9 J	--	--	--

Notes: SWMU = solid waste management unit.

D = duplicate.

µg/kg = micrograms per kilogram.

-- = analyte not detected.

PAH = polynuclear aromatic hydrocarbons.

mg/kg = milligrams per kilogram.

J = estimated value.

#### 4.0 EVALUATION OF TECHNOLOGY DEMONSTRATION

SSR collected soil samples to conduct a pretreatment analysis and to assess the treatability test and posttreatment of the petroleum-impacted soil during the full-scale demonstration. Below is a discussion of the three sampling events conducted by SSR.

Pretreatment Analysis. SSR stated in their report that total organic halides were not detected in their pretreatment soil samples (SSR, 1996). This is consistent with the analytical results of pretreatment samples collected by ABB-ES. The two analyses support the assumption that hazardous substances that are not allowed to be treated by thermal desorption, if present, are not at concentrations that would preclude the use of thermal desorption to remediate the soil.

Xylenes, TRPH, and arsenic, barium, cadmium, chromium, lead, mercury and selenium were detected in SSR's pretreatment soil samples (Table 4-1). The pretreatment analytical results were compared to the treatment levels to identify which petroleum-related constituents exceeded the treatment criteria and should also be evaluated in the posttreatment samples. Xylenes were detected in four of the pretreatment soil samples at concentrations that were not in compliance with the thermal desorption cleanup level for total volatile organics (Tables 1-1 and 4-1). The thermal desorption criteria for TRPH were also not met for each of the soil samples. The analytical results for the inorganic analytes suggest that they are in conformance with the thermal desorption criteria.

Treatability Testing. The treatability test results suggest that the thermal desorption unit is capable of treating the petroleum-impacted soil to levels that are in conformance with the thermal desorption criteria (Table 4-2). One soil pile, C-5, had to be retreated because the criteria for TRPH were not met. After retreatment, the TRPH results were in conformance with the thermal desorption criteria (SSR, 1996).

Full-Scale Treatment. Posttreatment analytical results suggest that 10 of 54 treated piles did not meet the thermal desorption treatment criteria for total volatile organics, and 7 of 54 piles did not meet the criteria for TRPH (Table 4-3). Entries in the operator's log indicate that six of the soil piles were retreated. The soil piles were indicated to have been moved back to and remixed with the pretreatment material.

With the exception of soil pile C-7, there is no record that specifically indicates when a pile was retreated and what the new number is for such a pile. Analytical results for pile C-7 suggest that the thermal desorption criteria for total volatile organics and TRPH were not met. However, the sample was reanalyzed for halogenated organics, which were not detected in the previous sample, rather than volatile aromatics BTEX and TRPH.

**Table 4-1**  
**Pretreatment Analytical Results<sup>1</sup>**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Sample Number	Analytical Results												
	Benzene	Toluene	Ethylbenzene	Xylenes (µg/kg)	TRPH (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
1	-	-	-	130	6,288	-	-	-	1.9	1.2	0.11	-	-
2	-	-	-	115	2,463	-	-	-	1.4	1.1	0.12	-	-
3	-	-	-	70	3,350	-	-	-	1.6	-	0.04	-	-
4	-	-	-	-	3,038	-	-	-	1.6	1.4	0.07	-	-
5	-	-	-	80	10,475	2.3	57.3	3.1	38.3	55.8	5.6	-	-
6	-	-	-	-	9,988	-	-	-	2.5	1.5	0.04	-	-
7	-	-	-	-	9,450	2	-	-	1.9	1.2	0.02	-	-
8	-	-	-	-	4,588	-	-	-	8.74	14.4	0.122	-	-
9	-	-	-	160	10,563	-	-	-	3.98	4.41	0.062	-	-
10	-	-	-	130	7,788	-	-	-	2.6	-	0.02	-	-
11	-	-	-	90	838	-	4.4	-	1.8	-	0.027	1.3	-
13 <sup>2</sup>	-	-	-	-	13,550	-	-	-	-	-	-	-	-
Cleanup Level <sup>3</sup>	<sup>3</sup> 100	<sup>3</sup> 100	<sup>3</sup> 100	<sup>4</sup> 100	10	10	490	37	50	108	23	389	353

<sup>1</sup> Analytical results are from Southwest Soil Remediation, Inc. (SSR), report *Summary Report Mayport Naval Station, Oily Waste Treatment Plant SWMUs 6 and 7* (1996).

<sup>2</sup> Sample number 12 was not analyzed (SSR, 1996).

<sup>3</sup> Thermal desorption cleanup levels for soil under Florida Administrative Code 62-775.400.

<sup>4</sup> The cleanup level is for the total concentrations of benzene, toluene, ethylbenzene, and xylenes.

Notes: SWMU = solid waste management unit.  
µg/kg = micrograms per kilogram.  
mg/kg = milligrams per kilogram.  
-- = concentration of analyte, if present, was less than the detection limit

- <sup>1</sup> Analytical results are from Southwest Soil Remediation, Inc. (SSR), report *Summary Report Mayport Naval Station, oily Waste Treatment Plant SWMUs 6 and 7* (1996).  
<sup>2</sup> Sample number 12 was not analyzed (SSR, 1996).  
<sup>3</sup> Thermal desorption cleanup levels for soil under Florida Administrative Code 62-775.400.  
<sup>4</sup> The cleanup level is for the total concentrations of benzene, toluene, ethylbenzene, and xylenes.

Notes: SWMU = solid waste management unit.  
µg/kg = micrograms per kilogram.  
mg/kg = milligrams per kilogram.  
-- = concentration of analyte, if present, was less than the detection limit.

**Table 4-2**  
**Treatability Test Analytical Results<sup>1</sup>**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Sample Number	Analytical Results													
	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Total BTEX (µg/kg)	TRPH (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
C-1	15	20	--	--	35	--	--	--	--	2.2	1.8	--	--	--
C-2	20	25	5	5	55	--	--	--	--	1.5	--	--	--	--
C-3	15	30	5	5	55	--	--	--	--	2.1	2	--	--	--
C-4	15	20	--	--	35	--	--	--	--	2.5	2.9	--	--	--
<sup>2</sup> C-5	20	35	5	5	65	<sup>2</sup> 13	--	--	--	3.3	3.5	--	--	--
Cleanup Level <sup>3</sup>	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	10	10	490	37	50	108	23	389	353

<sup>1</sup> Analytical results are from Southwest Soil Remediation, Inc., report *Summary Report Mayport Naval Station, Oily Waste Treatment Plant SWMUs 6 and 7* (1996).

<sup>2</sup> Stockpile C-5 was returned and resampled. After treatment, the concentration of TRPH was less than 5 mg/kg.

<sup>3</sup> Thermal desorption cleanup levels for soil under Florida Administrative Code 62-775.400.

<sup>4</sup> The cleanup level is for the total concentrations of BTEX.

Notes: SWMU = solid waste management unit.  
BTEX = benzene, toluene, ethylbenzene, and xylenes.  
TRPH = total recoverable petroleum hydrocarbons.  
µg/kg = micrograms per kilogram.  
mg/kg = milligrams per kilogram.  
-- = concentration of analyte if present was less than the detection limit.

<sup>1</sup> Analytical results are from Southwest Soil Remediation, Inc., report *Summary Report Mayport Naval Station, Oily Waste Treatment Plant SWMUs 6 and 7* (1996).

<sup>2</sup> Stockpile C-5 was returned and resampled. After treatment, the concentration of TRPH was less than 5 mg/kg.

<sup>3</sup> Thermal desorption cleanup levels for soil under Florida Administrative Code 62-775.400.

<sup>4</sup> The cleanup level is for the total concentrations of BTEX.

Notes: SWMU = solid waste management unit.

BTEX = benzene, toluene, ethylbenzene, and xylenes.

TRPH = total recoverable petroleum hydrocarbons.

µg/kg = micrograms per kilogram.

mg/kg = milligrams per kilogram.

-- = concentration of analyte, if present, was less than the detection limit.

**Table 4-3**  
**Posttreatment Analytical Results<sup>1</sup>**  
 Navy Environmental Leadership Program  
 Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
 U.S. Naval Station  
 Mayport, Florida

Sample Number	Analytical Results													
	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Total BTEX (µg/kg)	TRPH (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
C-6	30	50	--	--	80	--	--	--	--	2.8	3.4	--	--	--
<sup>2</sup> C-7	20	40	20	30	110	16	--	--	--	3	3.3	--	--	--
C-7 Retest	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
C-8	15	30	15	45	105	22	--	--	--	2.1	2.1	--	--	--
C-9	20	35	10	15	80	18	--	--	--	2.4	1.2	--	2.8	--
C-10	10	30	10	10	70	34	--	--	--	1.8	16	--	--	--
C-11	5	25	5	10	45	--	--	5.2	--	2.3	1.7	--	--	--
C-12	20	35	10	15	80	--	--	3.3	--	1.5	--	--	--	--
<sup>2</sup> C-13	25	45	20	50	140	13	--	4.4	--	1.7	1	--	--	--
C-14	15	20	25	15	75	10	--	5	--	2.2	1.2	--	--	--
C-15	20	35	10	15	80	--	--	4.7	--	2.4	1.2	--	--	--
C-16	15	30	10	15	70	5	--	8.4	--	2.8	1.8	--	--	--
C-17	15	30	20	50	115	18	--	5.4	--	2.1	1.5	--	--	--
C-18	22	41	15	25	103	--	--	7	0.28	3.4	3	--	--	--
<sup>2</sup> C-19	NP	NP	NP	NP	NP	--	--	--	--	1.7	1.3	--	--	--
<sup>2</sup> C-20	NP	NP	NP	NP	NP	--	--	--	--	2.1	1.6	--	--	--
C-21	NP	NP	NP	NP	NP	--	--	--	--	2.5	2.3	--	--	--
C-22	30	37	20	39	126	--	--	--	--	2.6	2.8	--	--	--
<sup>2</sup> C-23	37	36	18	33	124	--	--	--	--	2.2	2.6	--	--	--
<sup>2</sup> C-24	52	52	23	45	172	--	--	--	--	2.5	4.7	--	--	--
C-25	23	29	7	28	87	--	--	--	--	3.9	3.7	--	--	--
C-26	26	37	19	36	118	--	--	--	--	2.9	2.7	--	--	--
C-27	67	73	25	64	229	--	--	--	--	3.9	4.8	--	--	--

See notes at end of table.

See notes at end of table.



**Table 4-3 (Continued)  
Posttreatment Analytical Results<sup>1</sup>**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Sample Number	Analytical Results													
	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Total BTEX (µg/kg)	TRPH (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
C-28	29	29	7	8	73	-	-	-	-	2.2	2.1	-	-	-
C-29	15	25	8	7	55	-	-	-	-	1.2	-	-	-	-
C-30	26	30	7	7	70	-	-	-	-	1.6	1.8	-	-	-
C-31	29	23	6	6	64	-	-	-	-	1.5	1.8	-	-	-
C-32	31	35	8	8	82	-	-	-	-	1.9	1.9	-	-	-
C-33	32	35	9	9	85	-	-	-	-	1.8	2.3	-	-	-
C-34	19	19	-	-	38	-	-	-	-	1.6	1.8	-	-	-
C-35	12	16	-	-	28	-	-	-	-	1.7	1.5	-	-	-
C-36	22	25	6	5	58	-	-	-	-	1.5	1.3	-	-	-
C-37	21	25	6	5	57	-	-	-	-	1.4	1.7	-	2.05	-
C-38	21	20	5	5	51	-	-	-	-	1.9	1.9	-	-	-
C-39	28	26	5	7	66	-	-	-	-	1.6	2.2	-	-	-
C-40	17	18	5	6	46	-	-	-	-	1.9	1.3	-	2.4	-
C-41	19	17	5	5	46	-	-	-	-	2.2	1.3	-	2.7	-
C-42	18	17	5	6	46	-	-	-	-	2	1.2	-	2.5	-
C-43	16	12	-	-	28	-	-	-	-	2.4	5.4	-	2.7	-
C-44	29	33	11	11	84	-	-	-	-	2.5	5.1	-	2.4	-
C-45	24	33	8	11	76	-	-	-	-	2.3	4.8	-	2.2	-
C-46	13	21	7	10	51	-	-	-	-	2.9	13.8	-	2.8	-
C-47	8	13	-	6	27	-	-	-	-	2.3	4.6	-	2.8	-
C-48	-	-	-	-	-	-	-	-	-	2.6	5	-	2.7	-
C-49	6	-	-	-	6	-	-	-	-	3.7	5.3	-	3.5	-
C-50	15	22	-	6	43	-	-	-	-	2	5.5	-	3.2	-

See notes at end of table.

See notes at end of table.

**Table 4-3 (Continued)**  
**Posttreatment Analytical Results<sup>1</sup>**

Navy Environmental Leadership Program  
Technology Demonstration for Thermal Desorption at SWMUs 6 and 7  
U.S. Naval Station  
Mayport, Florida

Sample Number	Analytical Results													
	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Total BTEX (µg/kg)	TRPH (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
C-51	26	25	6	6	63	-	-	-	-	2.8	5.1	-	-	-
C-52	19	16	-	-	35	-	-	-	-	3.3	8.4	-	2.6	-
C-53	24	26	-	5	55	-	-	-	-	2.7	7.1	-	3.3	-
C-54	33	28	-	-	61	-	-	-	-	3.9	7.3	-	3.8	-
Cleanup Level <sup>3</sup>	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	<sup>4</sup> 100	10	10	490	37	50	108	23	389	-

<sup>1</sup> Analytical results are from Southwest Soil Remediation, Inc., report *Summary Report Mayport Naval Station, Oily Waste Treatment Plant SWMUs 6 and 7* (1996).

<sup>2</sup> Soil pile was indicated in SSR's report to have been moved and mixed with the preburn pile, then retreated.

<sup>3</sup> Thermal desorption cleanup levels for soil under Florida Administrative Code 62-775.400.

<sup>4</sup> The cleanup level is for the total concentrations of BTEX.

Notes: SWMU = solid waste management unit.

µg/kg = micrograms per kilogram.

BTEX = benzene, toluene, ethylbenzene, and xylenes.

TRPH = total recoverable petroleum hydrocarbons.

mg/kg = milligrams per kilogram.

-- = concentration of analyte, if present, was less than the detection limit.

NR = analysis not requested by SSR (SSR, 1996).

NP = Analytical results were not provided in SSR's report (SSR, 1996); however, the chain-of-custody documents that the analysis was requested.

## 5.0 CONCLUSIONS

The LTDD technology demonstration appears to have been effective in meeting the requirements of FAC 62-775 for the petroleum-impacted soil at SWMUs 6 and 7. However, there is some uncertainty associated with the lack of documentation (SSR, 1996) concerning whether or not some of the piles were retreated and the results of the retreatment (Table 4-3). SSR indicated that the moisture content of the soil was higher than expected, which resulted in their operating the thermal desorption unit at lower feed rates and higher temperatures than were used during the treatability test. The oyster shells that were in the soil matrix may also have hindered the treatment of the soil.

Based on the results of the technology demonstration, thermal desorption appears to be an appropriate technology to remediate the petroleum-impacted soil at SWMUs 6 and 7. However, should this technology be used to treat the remainder of the petroleum-impacted soil at SWMUs 6 and 7, a larger rotary dryer unit that would allow for more residence time would be appropriate.

## REFERENCES

- ABB Environmental Services, Inc. (ABB-ES). 1991. *Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Workplan, U.S. Naval Station, Mayport, Florida, Volumes I, II, and III (Interim Final)*. Prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFAC-ENGCOM), North Charleston, South Carolina.
- ABB-ES. 1995a. *Resource Conservation and Recovery Act (RCRA) Facility Investigation Group II Solid Waste Management Units (SWMUs), U.S. Naval Station, Mayport, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.
- ABB-ES. 1995b. *Corrective Measures Study Group II Solid Waste Management Units (SWMUs), U.S. Naval Station, Mayport, Florida*. Prepared for SOUTHNAVFAC-ENGCOM, North Charleston, South Carolina.
- ABB-ES. 1995c. *Resource Conservation and Recovery Act (RCRA) Corrective Action Program General Information Report, U. S. Naval Station, Mayport, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.
- E.C. Jordan Company, Inc. 1988. *Navy Installation Restoration Program Expanded Site Investigation, Final Report, U.S. Naval Station, Mayport, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (April).
- Environmental Science and Engineering, Inc. 1986. *Initial Assessment Study, Naval Station, Mayport, Florida*. Prepared for Naval Energy and Environmental Support Activity, U.S. Navy (May).
- Florida Department of Environmental Protection (FDEP). 1992. "Thermal Treatment Facilities for Petroleum-Contaminated Soil." Florida Administrative Code (FAC) 62-775. Tallahassee, Florida.
- FDEP. 1994. *Guidelines for Assessment and Remediation of Petroleum-Contaminated Soil*. Division of Waste Management, Bureau of Waste Cleanup, Engineering Support Section. Tallahassee, Florida (May).
- Kearney, A. T. 1989. *RCRA Facility Assessment of the Naval Station Mayport, Jacksonville, Florida (Final Report)*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (April).
- Southwest Soil Remediation, Inc. (SSR). 1995. *Low Temperature Thermal Desorption Workplan, SWMUs 6 and 7, U.S. Naval Station, Mayport, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.
- SSR. 1996. *Summary Report Mayport Naval Station, Oily Waste Treatment Plant SWMU 6 and 7*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.
- U.S. Environmental Protection Agency (USEPA). 1986. *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods: SW846*. Washington, D.C.

REFERENCES (Continued)

USEPA. 1990. *National Functional Guidelines for Organic Data Review*: December, (revised June, 1991). Washington, D.C.

USEPA. 1991. *Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*. USEPA Region IV, Environmental Services Branch. Athens, Georgia (February).

**APPENDIX G**  
**RESPONSE TO REGULATORY COMMENTS**

## 1.0 INTRODUCTION

As part of the Navy Environmental Leadership program (NELP), the Navy contracted Southwest Soil Remediation, Inc. (SSR), of Tucson, Arizona, to conduct a technology demonstration of low temperature thermal desorption of petroleum-contaminated soil at Naval Station Mayport. The demonstration was performed at Solid Waste Management Units (SWMUs) 6 and 7, the Waste Oil Pit and Sludge Drying Beds. Target treatment levels were set according to Florida Administrative Code (FAC) 62-775, Thermal Treatment Facilities for Petroleum Contaminated Soil. ABB Environmental Services, Inc. (ABB-ES), collected baseline and performance evaluation soil samples to evaluate the effectiveness of the technology demonstration.

The purpose of this document is to respond to comments by the Florida Department of Environmental Protection (FDEP) concerning the draft report (June 1997), entitled *Technology Evaluation Report Navy Environmental Leadership Program Technology Demonstration for Thermal Desorption of Petroleum-Impacted Soil at SWMUs 6 & 7, U.S. Naval Station, Mayport, Florida* (ABB-ES, 1997). The U.S. Environmental Protection Agency declined to comment on the report.

The following correspondence was received from FDEP.

- September 30, 1997, Correspondence from James H. Cason, P.G. Remedial Project Manager, FDEP, to Mr. David Driggers, Department of the Navy, Southern Division Naval Facilities Engineering Command, Subject: Draft Technology Evaluation Report: Naval Environmental Leadership Program Technology Demonstration of Petroleum-Impacted Soil at SWMU 14.

The following chapter provides point-by-point responses to FDEP's comments.

## 2.0 RESPONSE TO FDEP COMMENTS

2.1 Comment 1. Please confirm the operating temperatures (refer to Section 2-2, page 2-5) as noted the entry appears to be in question.

The entry is correct and inadvertently highlighted. The highlight will be removed.

2.2 Comment 2. Because of the uncertainty in retreatment of some soil batches that was noted in the desorber operating records, the Navy should consider conducting limited random sampling to insure that the remediated soil is in conformance with clean soil standards. These data can then be incorporated into the final overall evaluation of SWMUs 6 and 7.

The *Guidelines for Assessment and Remediation of Petroleum Contaminated Soil* (FDEP, 1994) stipulates that a grab sample should be collected every 50 tons of treated soil and composited every 400 tons. ABB-ES collected one composite sample for every 400 tons of treated soil designated as achieving target treatment levels by SSR. Each composite consisted of eight grab samples: one to two grab samples collected from each 56 to 72-ton stockpile.

Evaluation of the analytical results of the performance samples suggest that none of the analytes were detected at concentrations that exceed the thermal desorption criteria. Though there are discrepancies in SSR's records, it would appear that based on the ABB-ES analytical results that the soil was successfully treated.

In addition, Visqueen™ was placed on the excavation subgrade to minimize the potential for the treated soil to become recontaminated by the wicking of petroleum or related constituents into the treated soil.

2.3 Comment 3. I suggest that one of the "lessons learned" in this demonstration is that the project would have been improved if the Navy had direct, full-time, and responsible charge of the actual operation of the desorption unit; this perhaps could have helped assure that all documentation was sufficient.

Comment acknowledged.



## REFERENCES

ABB-Environmental Services, Inc (ABB-ES), 1997. *Technology Evaluation Report, Navy Environmental Leadership Program Technology Demonstration for Thermal Desorption of Petroleum-Impacted Soil at Solid Waste Management Units 6 and 7, U.S. Naval Station, Mayport, Florida (Draft)*. Prepared for Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina (July).